ON DIMORPHISM IN THE FEMALES OF AUSTRALIAN AGRIONIDÆ.

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In the Proceedings of this Society for 1905 (p.302) I described a dimorphic form of the female of *Ischnura heterosticta* Burm. Since that time further examples of dimorphism have come to light, and the present paper is the outcome of the results of my investigations in this direction.

Of all the genera comprising the Australian Agrionidæ, there are only two in which I have been able to discover the phenomenon of dimorphism. These two contain the smallest and weakest species of the dragonflies known in Australia, a point which serves to strengthen the contention that the existence of dimorphic females is in some manner or other connected with the preservation of the species. The two genera in question are *Ischnura* and *Agriocnemis*. Of the former, three species (*I. heterosticta* Burm., *I. delicata* Selys, *I. senegalensis* Rambur) are known to inhabit Australia. The case of *I. heterosticta* has been already dealt with. *I. senegalensis* I have never yet taken, but its similarity to *I. heterosticta* leads me to believe that in any

spot where it is common, a careful search will reveal the existence of a dimorph. As regards *I. delicata*, this insect differs greatly both in size and colouration from the other two; however, I was confident that a dimorphic form would be found to exist. But, in spite of its abundance all over the Eastern States, a careful search for many months failed to reveal the desired form. It was only during my trip to Western Australia, in January last, that I was successful in discovering the dimorphic female. It is a distinctly rare form, and where it occurs, it numbers only about 10% of the females taken; whereas in the case of *heterosticta* the dimorph occurs in every locality and is nearly as common as the ordinary form.

As regards the genus *Agriocnemis*, on account of the rarity of most of the species, my data are necessarily incomplete, but they are sufficient to show the existence of a series of dimorphic females of a different type from those of *Ischnura*. The dimorphs of *Ischnura* in Australia are male-mimicking, but in other countries, dimorphs of this genus have been recorded, known as "orange" forms from their prevailing colour. The dimorphs of *Agriocnemis* may also be classed as "orange" or "red" forms, and are remarkable for showing not the slightest resemblance either to the male or to the ordinary form of the female, so much so that in some cases I have been for a long time deceived as to the identity of the insect (see *Agriocnemis pruinescens* below). The series is very incomplete in this genus, and in only one species have I found both forms of the female; but in the other species, the one form of female that is so far known to occur is sometimes an ordinary form and sometimes an "orange" or "red" form. Hence I have arranged all the known females into two groups, feeling certain that, as in the case of *I. delicata*, a careful search for a second form of the female, where still wanting, will be well rewarded. There is of course also the possibility that amongst these extremely rare species of *Agriocnemis* one of the two forms of female has already died out, thus accelerating the final demise of the species.

Genus Ischnura.

I. heterosticta Burm., possesses a well-developed dimorphic female, a complete mimic of the male. This form occurs in all localities where the ordinary form is found and is fairly common, comprising from 30-40% of all the females taken.

I. delicata Selys.—The dimorphic female, which is a well-developed male-mimicking form, is exceedingly rare, only occurring in a few localities in South-Western Australia. I took it first at Bridgetown on the Blackwood River. The species is by no means common here; out of a dozen females taken two were dimorphs. At Wilgarrup, some fifteen miles from Bridgetown, and in the Warren River district, this species was in great abundance, the males flying up in clouds from the rich grass that fringes the continually running and often boggy creeks. Here I was able to capture a great many females, with the result that about 10% were dimorphs. Three of these had the tips of the abdomen smeared with brown mud, indicating that they had already been ovipositing along the margins of the creek.

The following is a comparative description of the two forms:—

Ischnura delicata Selys ♀.

Total length 24-25 mm.; abdomen 19-20 mm.; forewing 14-15 mm.; hindwing 13-14 mm.

Wings: Neuration very slender, pterostigma lozenge-shaped, 0·6 mm., very pale dirty brown. *Nodal Indicator* $\frac{2\ 6\text{-}8}{2\ 5\text{-}6}$ Head: *Eyes* black above, yellowish-green in front and below; a brilliant pale blue spot on the orbit behind each eye. *Epicranium* black, with a transverse yellowish-green band in front next the clypeus, in a line with the green portion of the eyes. *Clypeus* black; *labrum* yellowish; *labium* pale dirty greyish-white, or straw-coloured. Thorax: *Prothorax* black above, yellowish on sides. *Meso-* and *metathorax* black above, with a pair of narrow olive-green or yellowish-green bands, sides greenish. *Legs* pale yellow or straw-coloured, femora marked with a black line for half their length from elbow.

Form A.	Form B.
Abdomen cylindrical, stouter than in male. Colour: 1-7 metallic black above (sometimes dull black or greenish-black), a pale transverse line in each suture; 8-10 dull black. Sides of all segments greenish.	Abdomen shaped as in A. Colour: 1 black above; sutures between 1 and 2 red; 2 with an irregular black basal patch; 3-5 bright red, a fine black transverse band along all the sutures; 6, four-fifths bright red, anal one-fifth black; 7 deep metallic black, basal and anal sutures touched with red; 8, basal two-thirds black, anal third pale blue; 9 blue, touched with black at base; 10 short, black. Sides of all segments pale orange.
Appendages separate, 0·15mm., subconical, rather blunt, black.	*Appendages* shaped as in A, brownish.

In a variety of Form B, taken at Wilgarrup, segment 2 of abdomen has basal half red with a large cup-shaped black mark, anal half black; 3-4 have a transverse anal black band, and 3 a transverse central black line; also the black line along the sutures of 3-5 is enlarged into a conspicuous narrow band. A similar variety occurs in the male, also intermediate forms.

Genus Agriocnemis.

A. pruinescens Tillyard.—The male of this insect is a dull blackish insect with the first two and last but one segments of abdomen clouded with greyish bloom. While in North Queensland I failed to capture the female, but a few months later I received from Mr. E. Allen, of Cairns, one male and three females of this species. The females are most remarkable, bearing not the slightest resemblance to the male; a first examination of them made me think they were orange forms of some species of *Ischnura*, as they bear a remarkable resemblance to that genus. However, the position of the first antenodal arising before the

arculus fixes them in the genus *Agriocnemis*, and their size and general facies show that they cannot possibly be the females of any but this, the largest of the genus. As the only specimens of this insect known are the three males and three females in my own collection, it is quite possible that an ordinary form of the female may be found to exist when further captures are made.

The following is a description of the female :—

Form A.—(Not known).

Form B.—Size variable. Total length 29-34 mm.; abdomen 22-26 mm.; forewing 18-20 mm.; hindwing 17-19 mm.

W i n g s : *Pterostigma* lozenge-shaped, 0·8 mm., very pale brownish, darkest at inferior angle. *Nodal Indicator* $\frac{2\ 8}{2\ 7}$ H e a d : *Epicranium* velvety black, a broad transverse yellow band in front reaching to the eyes and enlarged so as to enclose the postclypeus; *ocelli* pale, front one transparent. *Postclypeus* jet-black, *anteclypeus* yellow; *labrum* dull yellowish; *labium* dirty straw-colour. T h o r a x : *Prothorax* black above, yellowish on sides. *Meso-* and *metathorax* rich orange, with a broad black dorsal ray, narrowing somewhat anally. *Legs*, coxæ, and femora orange, rest dull blackish. A b d o m e n cylindrical, 1-2 and 8-9 slightly enlarged. Colour : 1 pale orange; 2 orange with a large black dorsal mark shaped like a bishop's mitre, or sometimes like an inverted goblet; 3-7 metallic bronzy-black, a pale transverse yellowish line in the sutures; 8-9 black, with a pale yellowish spot on each side; 10 black. Sides and underside of abdomen yellowish. A p p e n d a g e s very short, separate, conical, black.

[For description of male, see these Proceedings for 1906 (p.177) "New Australian Species of the Family Agrionidæ."]

A. splendida Martin.—This is the commonest of the Australian species of this genus, having been taken by myself at Atherton in North Queensland, and also by Captain Billinghurst on the Goulburn River at Alexandra (Vic.). M. René Martin has described the species, but owing to the colouration of the living

insect fading when dead, his description varies considerably from that of the living insect itself. Last December I took a long series of this insect at Alexandra (Vic.), and the description I made from them corresponds almost exactly with that of the North Queensland specimens which I took two years ago, although the Victorian insects are slightly larger. This species exhibits strong dimorphism, having both an ordinary type of female (similar to the male) and also a fairly abundant red form, nearly as common as the other.

The colour of the male is a rich bronze-green, *not* a brilliant green as stated by M. Martin. The dimorphic female is a deep brick-red, *not* yellow or orange. The following is a comparative description of the two females :—

A. splendida Martin ♀.

Total length 20-23mm.; abdomen 17-19mm.; forewing 11-14mm.; hindwing 10-13 mm.

Wings: Pterostigma rhomboidal, 0·5 mm , dull olive-brown. *Nodal Indicator* $\left\|\begin{matrix}2 & 7\\ 2 & 6\text{-}7\end{matrix}\right|$

Form A.

Head.—*Eyes* black above, greenish beneath, orbits black underneath. *Epicranium* brilliant bronze, giving copper-red reflections; *behind each eye is a large spot of deep metallic blue. Postclypeus pale blue* shading to greenish in centre; the blue colouration enlarged on to the eyes; *anteclypeus metallic bronzy-green*, clypeal suture black. *Labrum pale blue*; *labium* dull dirty yellowish-white, mouth tipped with black.

Form B (dimorph).

Head.—*Eyes* black. *Epicranium* deep bronze, *lacking the metallic blue postocular spots*; a broad transverse yellowish band in front extending to the eyes and surrounding the clypeus. *Postclypeus black*; *anteclypeu* sand *labrum yellowish*; *labium* pale dirty yellowish-white.

Form A.	Form B.(dimorph).
Thorax.—*Prothorax bronze. Meso-* and *metathorax* deep bronze-green with an irregular *light blue* patch low down on each side, extending from hind wing-join to between meso- and metacoxæ; the blue edged with black. *Scuta* and *scutella* blue.	Thorax.—*Prothorax rich brick-red. Meso-* and *metathorax* deep metallic bronzy-black above; sides and notum *rich brick-red.*
Legs very long; deep brown or black.	*Legs* very long, femora rich brick-red, or red-brown, rest dull blackish.
Abdomen cylindrical; 1-8 *rich bronze* touched with yellow lines in the sutures; 8 with a transverse *blue* anal mark; 9 *blue* with a double basal bronze spot (separated into two separate spots in some specimens); 10 *blue* with a small double central spot of bronzy-black. Underside dull blackish.	Abdomen cylindrical; 1 *rich brick-red*; 2 *red*, with a narrow transverse basal black band and a black anal spot; 3-9 dark bronze, sutures pale; sides of 8-9 dull orange-red; 10 black above, orange-red on sides.
Appendages short, separate, rather blunt, dull brownish.	*Appendages* as in A, dull yellowish-brown.

A. argentea Tillyard.—Only one form of female is known. The colour of the male is silvery-white, due to a bloom forming all over the insect. Where this is rubbed off, the groundcolour is seen to be black. The colour of the female is black. I consider this as the ordinary form of female; the "red" or dimorphic form being either not known or obsolete.

A. velaris Selys.—This rather rare insect occurs in North Queensland at Atherton, and also sparingly about Sydney. In both localities I have taken only one form of female, which differs completely from the male, being a "red" or dimorphic

form. The markings of the thorax show great similarity with those of the "orange" female of *A. pruinescens* described above, but the groundcolour is dull red and the insect is very much smaller. There may be also an ordinary form of female, yet to be found or, it may be, obsolete. I have only half-a-dozen females of this insect altogether.

The following table exhibits the classification proposed for the known forms of the two genera.

Genus Ischnura.

Name.	Male.	Females.		Proportion of Form B to total number of Females.
		Form A (ordinary)	Form B (dimorph)	
I. heterosticta	bronze and blue	dull black	imitates ♂	30-40 %.
I. delicata	red and blue	dull black or olive-green	imitates ♂	10 % in S. W. Australia; absent elsewhere.

Genus Agriocnemis.

Name.	Male.	Females.		Proportion of Form B to total number of Females.
		Form A (ordinary)	Form B (dimorph)	
A. pruinescens	black with grey bloom	(wanting)	orange	100 %.
A. splendida	bronze and blue	similar to ♂	red	40 %.
A. argentea	silvery-white (groundcolour black)	black	(wanting)	0 %.
A. velaris	bronze with red tip	(wanting)	red	100 %.

In conclusion I would remark that the two genera in which dimorphism is shown to occur, though differing widely in their wing-structure, have many points of similarity, notably the small size and weak flight of almost all the species, the general facies

of the insects, particularly the build of the head and thorax, and the relative proportion of expanse of wing to total length (about 5 to 4 in both genera). So great is this similarity that, if the wings were removed from one of the "orange" females of *Agriocnemis pruinescens*, one would unhesitatingly declare it to be a new form of the female of *I. heterosticta* or an allied species; and such I took it to be until I saw the difference in the neuration of the wings. That the same cause has brought about dimorphism in both genera is scarcely open to doubt; and it is probable that the dimorphism is in some way connected with the preservation of the species.